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Construction Quality Assurance in Permits for Hazardous Waste Land Disposal Facilities

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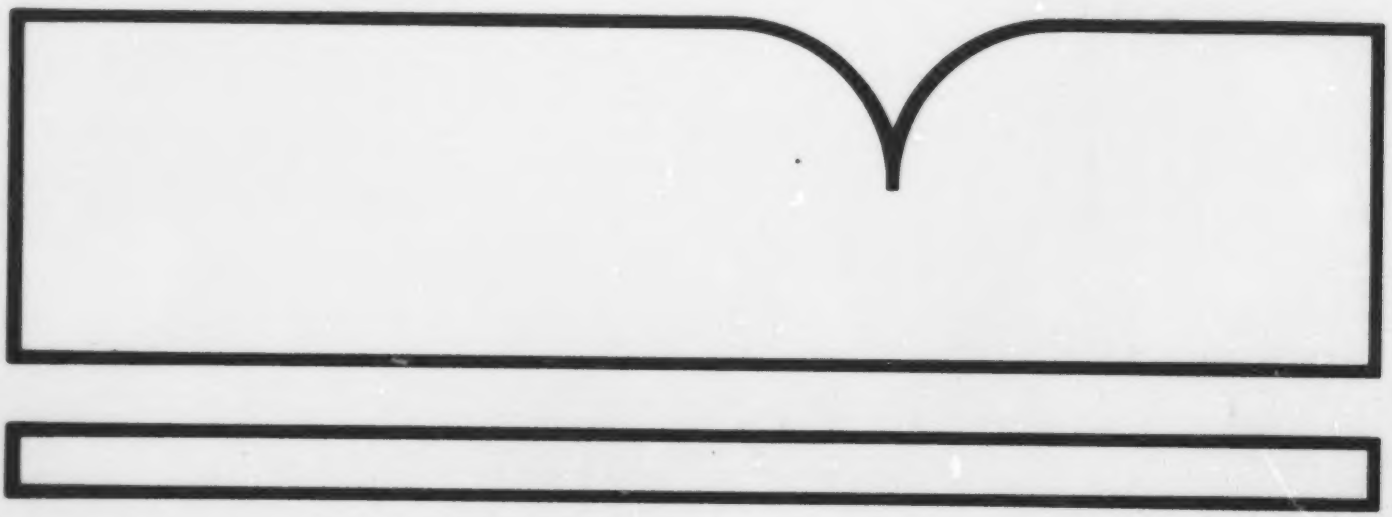

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CONSTRUCTION QUALITY ASSURANCE IN PERMITS FOR HAZARDOUS WASTE LAND DISPOSAL FACILITIES

by

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The CQA Technical Guidance Document will assist permitting agencies, facility owner/operators, design engineers, CQA personnel, and construction contractors in ensuring, with a resonable degree of certainty, that the completed facility meets or exceeds all design criteria, plans, and specifications. It supports the proposed Minimum Technology Guidance being developed by OSW, which will address system designs that may be used to ensure compliance with the Minimum Technology Requirements of the Hazardous and Solid Waste Amendments of 1984.

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ABSTRACT

The U. S. Environmental Protection Agency's (USEPA's) Hazardous Waste Engineering Research Laboratory (HWERL) has prepared a Technical Guidance Document, at the request of the Office of Solid Waste (OSW), on construction quality assurance (CQA) for hazardous waste land disposal facilities. This document has recently undergone public comment and is currently being revised in accordance with those comments received.

This paper summarizes the contents of the CQA Technical Guidance Document. It describes the elements of a CQA plan that should be addressed when preparing the permit application for a specific site. These include: the areas of responsibility and lines of authority used in executing the plan, the requisite qualifications of the construction quality assurance personnel, the types of inspection activities to be performed as a part of assuring quality during construction, the sampling requirements (including sampling frequency, size, and location; acceptance criteria; and corrective measures), and the documentation of CQA activities. Quality assurance is described for the construction or installation of several facility components (i.e., foundations, dikes, low-permeabiltiy soil liners, flexible membrane liners (FMLs), leachate collection systems and final cover systems.)

The CQA Technical Guidance Document will assist permitting agencies, facility owner/operators, design engineers, CQA personnel, and construction contractors in ensuring, with a reasonable degree of certainty, that the completed facility meets or exceeds all design criteria, plans, and specifications. It supports the proposed Minimum Technology Guidance being developed by OSW, which will address system designs that may be used to ensure compliance with the Minimum Technology Requirements of the Hazardous and Solid Waste Amendments of 1984.

INTRODUCTION

Managing construction quality at a hazardous waste land disposal facility (i.e., landfill, surface impoundment, waste pile) is the responsibility of the faciltiy owner/operator. It involves using scientific and engineering principles and practices to ensure, with a reasonable degree of certainty, that a completed facility meets or exceeds all design criteria,

plans, and specifications. This management activity begins during the design of the faciltiy, continues throughout construction, and ends when the completed facility is accepted by the owner/operator.

Construction quality management is comprised of both a planned system of inspection activities that are necessary to monitor and control the quality of a construction project and a planned system of overview activities that provide assurance that these inspection activities are being properly performed and documented and that the resulting data are properly interpreted. For hazardous waste land disposal facilities construction quality assurance (CQA) may involve tests, test verifications, audits, and evaluations and documentation of the factors that affect the installation, inspection, and performance of the facility.

The U. S. Environmental Protection Agency's (USEPA's) Hazardous Waste Engineering Research Laboratory (HWERL), at the request of the Office of Solid Waste (OSW), has prepared a Technical Guidance Document entitled, "Construction Quality Assurance for Hazardous Waste Land Disposal Facilities." (6) The document presents guidance for developing a site-specific CQA plan for landfills, surface impoundments, and waste piles. It is intended for the use of those organizations involved in the permitting, design, and construction of hazardous waste land disposal facilites (i.e., permitting agencies, facility owner/operators, design engineers, CQA personnel, and construction contractors.)

The information presented in the CQA Technical Guidance Document addresses the following components of a hazardous waste land disposal facility: foundations, dikes, low-permeability soil liners, flexible membrane liners (FMLs), leachate collection systems, and final cover systems. The Technical Guidance Document can be used in conjunction with the proposed Minimum Technology Guidance being developed by OSW. The Minimum Technology Guidance provides both permitting agencies and owner/operators with information on component designs for hazardous waste land disposal facilities. In the Minimum Technology Guidance for double liner systems (7), emphasis is placed on the submission of a site-specific CQA plan that consists of five elements:

- Responsibility and Authority
- CQA Personnel Qualifications
- Inspection Activities
- Sampling Requirements
- Documentation

Each of these elements is summarized this paper.

RESPONSIBILITY AND AUTHORITY

The first element of a CQA plan is the clear delineation of the areas of responsibility and lines of authority for each organization involved in permitting, design, and construction of the hazardous waste land disposal facility.

Permitting Agency

The permitting agency (i.e., the State agency or the U. S. Environmental Protection Agency) is required by law to issue a permit for the construction and operation of a hazardous waste land disposal facility. The permitting agency reviews the facility owner/operator's permit application for compliance with the agency's requirements (i.e., regulations) and writes a permit or denies the application based on this review. The agency also reviews and accepts or rejects any design revisions or requests for variance that are submitted by the facility owner/operator.

Facility Owner/Operator

The facility owner/operator is responsible for the design, construction, and operation of the hazardous waste land disposal facility. The owner/operator must comply with the requirements of the permitting agency for obtaining a permit and must demonstrate good faith compliance with agency requirements. One way to address this requirement is by submission of a CQA plan during facility permitting along with CQA documentation showing that the completed facility meets or exceeds the specified design. The owner/operator may select and dismiss parties charged with design, CQA, and construction activities. The owner/operator also has the authority to accept or reject design plans and specifications, CQA plans, progress reviews and recommendations of the CQA officer, and the materials and workmanship of the contractor(s).

Design Engineer

The design engineer's primary responsibility is to design a hazardous waste land disposal facility that fulfills the needs of the facility owner/operator regarding facility function. Design activities may not end until the facility is completed; the design engineer may have to change some design features if unexpected site conditions are encountered or changes in construction methodology occur that could adversely affect facility performance. CQA ensures that these unexpected changes or conditions will be detected, documented, and corrected during construction.

Additional responsibility given the design engineer may include formulating the site-specific CQA plan, periodic review of CQA documentation, modifying construction site activity, and

specifying corrective measures in cases where deviation from the specified design is detected by the CQA personnel.

CQA Personnel

CQA personnel should include a CQA officer and inspection staff. The specific responsibilities and authority of each of these individuals should be clearly defined in the CQA plan and in associated contractual agreements with the facility owner/operator. For the CQA officer, specific responsibilities may include:

- o Reviewing design drawings and specifications for clarity and completeness.
- o Serving as the owner/operator's or design engineer's liaison with the construction contractor in interpreting and clarifying project drawings and specifications.
- o Educating construction and inspection personnel on job requirements.
- o Scheduling site inspections.
- o Directing and supporting the inspection staff in performing observations and tests.
- o Providing reports on the inspection results to the facilitiy owner/operator.
- o Verifying that the contractor's construction quality control plan is being followed.

For the supporting inspection staff, specific responsibilities may include:

- o Verifying that quality control testing equipment are appropriate and that tests are conducted by qualified personnel according to the procedures defined by the CQA plan.
- o Monitoring all quality control tests conducted by the construction contractor's personnel that may be required by the contract and/or the design specifications.
- o Performing independent tests and onsite inspection of the work in progress to assess compliance by the contractor with the facility design criteria, plans, and specifications.
- o Reporting results of all observations and tests to the construction contractor as the work progresses and interacting with him to modify the materials and processes to comply with the specified design.

- Reporting results of all inspections to the CQA officer including work that is not of acceptable quality or fails to meet the specified design.

Construction Contractor

It is the responsibility of the construction contractor to construct the hazardous waste land disposal facility in strict accordance with the specified design. This responsibility may be expanded, as part of the contractual agreement with the facility owner/operator, to include construction quality control as an adjunct to the CQA plan. The construction contractor has the authority to direct and manage his employees and equipment to best accomplish the construction of the facility.

CQA PERSONNEL QUALIFICATIONS

The CQA plan should include a specific section listing the CQA personnel assigned to the project, documenting their education and experience, and describing their expected duties.

CQA Officer

The CQA officer is that individual assigned singular responsibility for all aspects of the construction quality assurance plan. The CQA officer directs the activities of the inspection staff and is responsible to the facility owner/operator. The CQA officer should be independent of jurisdiction from the construction contractor(s). The location of the CQA officer within the overall organizational structure of the project should be clearly described in the CQA plan.

The CQA officer should possess adequate formal academic training in engineering, engineering geology, or closely associated disciplines and substantial practical and technical experience in participating in and managing construction quality assurance activities. Since the CQA officer will be expected to interrelate with all levels of personnel involved in the project, good communication skills are essential. The CQA officer should be expected to ensure that communication of all CQA-related matters is conveyed to and acted upon by the affected organizations.

Inspection Staff

The inspection staff should possess adequate formal training and sufficient practical technical experience to execute and record inspection activities successfully. This should include knowledge of specific field construction techniques and equipment used for hazardous waste land disposal facilities, all codes and regulations concerning material and equipment installation, observation and testing procedures, equipment, documentation procedures and site safety.

INSPECTION ACTIVITIES

The third element of the CQA plan should describe the inspection activities (observations and tests) that will be performed during construction. These activities are critical. They determine whether the properties, composition, and performance of materials or installed components are within the limits established by the specified design.

Specific inspection activities associated with foundations, dikes, low-permeability soil liners, FMLs, leachate collection systems, and final cover systems are described in detail in the CQA Technical Guidance Document and are drawn from various standard testing codes (1,2). Preconstruction, construction, and post-construction inspection activities are described for each component. Particular emphasis has been given to inspections and tests of soils and FMLs during construction or installation. Thus, for soils, tests of permeability and associated moisture content, density, and compactive effort are of great importance. For FMLs, tests for seam continuity and strength are examples of more important activities.

CQA includes many other inspection activities. Some are conducted prior to any construction. For example, the CQA officer may review the design drawings and specifications for the hazardous waste land disposal facility to ensure that they are understandable to both the CQA personnel and the construction contractor. The contractor's prior performance in general construction activities and in constructing hazardous waste land disposal facilities may be assessed. The CQA officer also may want to evaluate the contractor's ability to perform a specific task before task performance during facility construction. It may be necessary to include a preconstruction training program in the site-specific CQA plan.

Post construction activities may include final testing of the construsted facility. Total visual inspection of an FML for holes and leaky seams, infiltrometer testing of a low-permeability soil liner, and performance testing (e.g., filling with water) of the leachate collection system are examples of post construction CQA activities.

SAMPLING REQUIREMENTS

Sampling requirements should be described as the fourth element of the CQA plan. Sampling requirements for construction materials and processes for the various components of a hazardous waste land disposal facility may include:

Size of the Unit (or Block) to be Sampled A unit or block is a definite isolated quantity of material or construction process, constant in composition and

produced uniformly, that is presented for inspection and acceptance as a unit. Examples might be a day's work, a shipment of construction material, or a stockpile.

Number of Sample Items or Measurements per Inspection Block The number may be established by the design engineer or CQA officer on the basis of judgment or by statistical methods, the later being ordinarily more defensible with respect to precision and reliability.

Location(s) of Sample Items or Measurements Locations for individual observations or for sampling may be established by the design engineer or CQA officer on the basis of judgment or by statistical methods. Here again, statistical methods may be more defensible, but judgement based on observation of deviations in construction procedures may be appropriate also.

Acceptance Criteria The determination of natural process variabilities, levels of confidence, and acceptance criteria for each characteristic are all design tasks, involving site-specific requirements and engineering experience, skill, and judgment. Acceptance criteria should reflect the type of sampling plan (judgment or statistical) that is employed. Rejection may be based on absolute limits for any maeasurement or on a limit which is the average of several measurements.

Treatment of Outliers Criteria for identifying and rejecting outlying test results may be established based on confidence level requirements (statistical sampling methods only) or based on the judgment of the CQA officer. The latter is less desirable and may be quite subjective.

Corrective Measures to be Taken in the Event of Noncompliance When a quantity of material or a completed process is rejected, it must be reworked to bring it up to specification or replaced by acceptable material. The actual physical means of correction in the case of noncompliance is a combined design and construction operations function.

DOCUMENTATION

The documentation of CQA activities is the fifth element of the CQA plan. Documentation is essential to confirm that CQA has been adequately implemented and to assist in any facility evaluations once construction has been completed.

Daily Reporting

Standard daily reporting procedures should include a

summary report prepared by the CQA officer with supporting inspection data sheets and, when appropriate, problem identification and corrective measures reports. All observation, and field and laboratory tests should be recorded on an inspection data sheet. Required data to be addressed for most of the standarized test methods are included in the pertinent AASHTO (1) and ASTM (2) standards. Examples of field and laboratory test data sheets are given in Department of the Army (4,5) manuals and in Spigolon and Kelley (3).

Because of their nonspecific nature, no standard format is provided for data sheets to record observations. Recorded observations may take the form of notes, charts, sketches, photographs, or any combination of these. Where possible, a checklist may be useful to ensure that no pertinent factors of a specific observation are overlooked.

In the event that inspection activities identify a problem with materials or processes that do not meet design criteria, plans and specifications, the problem, as well as the measure used to correct the problem should be documented and the CQA officer should be informed. Photographs may prove useful during inspection activities and if used should be clearly identified and cross-referenced or appended to the appropriate inspection data sheets.

Block Evaluation Reports

Within each inspection block, there may be several quality characteristics that are specified for observation or testing, each by a different observation or test with the results recorded on different data sheets. At the completion of each block, these data sheets should be organized into a block evaluation report. These block evaluation reports may then be used by the CQA officer to later summarize all of the site construction activities.

Design Engineer's Acceptance of Completed Components

All daily inspection summary reports, inspection data sheets, problem identification and corrective measures reports, and block evaluation reports should be reviewed by the CQA officer and then submitted to the design engineer. The reports should be evaluated by the design engineer for internal consistency and for consistency with similar work. Timely submittal of these documents will permit errors, inconsistencies, and other problems to be detected and corrected as they occur, when corrective measures are easiest.

The design engineer should assemble and summarize the above information into periodic Design Acceptance Reports. The reports should confirm that the materials and construction processes comply with design specifications and permit requirements. These reports should be included in project records and, if requested, submitted to the permitting agency.

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Final Documentation

At the completion of the project, the facility owner/operator should submit a final report to the permitting agency. This report should include a summary of the aforementioned data sheets and reports, deviations from design and material specifications (with justifying documentation), and as-built drawings. This document should be prepared and certified correct by the CQA officer and be included as part of the CQA plan documentation. Final documentation submitted to the permitting agency as part of the CQA plan documentation does not sanction the CQA plan as a guarantee of facility construction and performance. Rather, the primary purpose of the final documentattion is to improve confidence in the constructed facility through written evidence that the CQA plan was implemented as proposed and that the construction proceeded in accordance with design criteria, plans and specifications.

CONCLUDING REMARKS

Construction quality assurance for hazardous waste land disposal facilities is one tool that can be very valuable in improving the overall performance of landfills, surface impoundments, and waste piles. Proper site selection, credible designs, knowledgeable contractors, and competent operation of the completed facility, along with adequate CQA, all contribute to a facility with a reduced potential for failure. Through the thorough application of a site-specific CQA plan, the owner/operator can ensure, with a reasonable degree of certainty, that the completed facility meets or exceeds all design criteria, plans, and specifications. The CQA Technical Guidance Document presents those elements of a CQA plan judged important by the USEPA and include: the areas of responsibility and lines of authority used in executing the plan, the requisite qualifications of the CQA personnel, the types of inspection activities to be performed as a part of assuring quality during construction, the sampling requirements (including sampling frequency, size, and location; acceptance criteria; and corrective measures), and the documentation of CQA activities.

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